MISSOURI BOTANICAL GARDEN

Bulletin

February 1961
Volume XLIX
Number 2

COVER: *Cypripedium* hybrid "Cyclops"

The annual Orchid Show (January 22 to February 26) is now on display. The Garden is featuring its extensive Cymbidium collection. These plants are in prime condition and help make this one of the finest displays the Garden has shown in many years.

CONTENTS

How Length of Night Regulates Flowering and Fruiting of Many Plants
True Cedars
The Anacards
Extraordinary Uses of Legume Seeds
The Pellitory Problem II
Mausoleum Restoration
Educational Programs
Special Lecture Announcement

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.

Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis 10, Missouri.

Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $3.50 a year.

Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under Act of March 3, 1879.

Missouri Botanical Garden Bulletin

Vol. XLIX No. 2 February 1961

HOW LENGTH OF NIGHT REGULATES FLOWERING AND FRUITING OF MANY PLANTS

F. W. WENT

Like so many botanists, Garner and Allard were puzzled by how plants could tell the seasons even when they were grown in a greenhouse and kept warm all winter. Some plants, notably a giant race of tobacco called Maryland Mammoth, never flowered during spring, summer, or early fall. Only in the middle of winter were flowers produced, regardless of the temperature of the green house. This was most inconvenient since Maryland Mammoth was desired for hybridizing with ordinary commercial varieties, but this was prevented by difference in flowering seasons. Innumerable experiments including shading, planting in different soils, and feeding with various combinations of nutrients all failed to alter flowering time. Finally Garner and Allard decided to shorten the daily period during which the tobacco was exposed to light. Every afternoon at 4 o'clock some plants were covered with a black box, which was removed next morning at 9 A. M. Promptly the covered plants started to flower, in the middle of summer, whereas the control plants, exposed to the full length of summer days, remained vegetative. This result was so startling and clear-cut that during the next year a study was made of the response of a large number of plants to the length of the light period to which they were exposed daily. This cycle was called photoperiod.

Further experiments were carried on with enthusiasm. In only a few years they resulted in a rather complete understanding of how plants have a sense of time, and how they are able to tell the seasons, regardless of unusually cold or warm springs or summers.

Short Days For Flowering

A number of plants flower *only* when the number of hours of daylight is reduced below a certain minimum, ordinarily about 12 hours. Such plants, requiring short photoperiods for flowering, are called short-day plants. Chrysanthemum, Aster, Cosmos, and Mexican sunflower belong to this group, which includes the majority of our autumn flowers.

Long Days For Flowering

Summer-flowering plants such as larkspur, flax, evening primrose, poppy, Clarkia, Nigella, and Rudbeckia are long-day plants. In other words, they flower *only* when they get *more* than a minimum number of hours of daylight. In winter they will flower in greenhouses only when additional

light is supplied, lengthening the normal winter day to a summer day.

Since the exact length of photoperiod necessary for flowering varies from plant to plant, they bloom at different times of the year. The long-day plants come into flower at some time after the days are lengthening; the short-day plants flower later in summer and in fall, when the days are shortening again.

Fixed Dates

In many plants, temperature has no influence on their photoperiodic response; they start flowering each year at exactly the same time. Such dated flowering makes it possible to set the date of flower shows months or even years in advance. The royal Chrysanthemums, the mainstays of most fall flower shows, set their flowering date by the length of day, or in other words, by the declination of the sun, irrespective of whether the preceding summer and early fall were exceptionally warm or cool. They follow the position of the sun in the sky.

Day-Neutral

Everyone is, of course, interested in what photoperiodicity means for the vegetable in his kitchen garden. Fortunately many vegetables are day-neutral, or, in other words, the length of day has nothing to do with their flowering. They may flower at any time of the year. As examples, potatoes, tomatoes, turnips, Savoy cabbage, and summer lettuce can be mentioned. In the case of summer lettuce varieties, flowering (or "bolting") is caused by high night temperatures (above 65–70°), so that they can be grown anywhere in a moderately cool climate without bolting in summer. Provided the night temperatures are within the right limits, tomatoes will set fruit throughout the year, for flowers are formed equally well in summer and in winter.

Long-Day Vegetables

Many of the leafy vegetables, however, are long-day plants, and start to flower in summer, thus ending their usefulness. Spinach and spring lettuce varieties are notorious in this respect. Many a gardener has become amazed at these vegetables which went to seed before he had time to harvest them. By sowing them very early in the season, a good crop can be obtained, for, during fall, winter, and early spring, the days are short enough to prevent flowering.

Vegetables which are grown for their seeds, such as peas, many beans, and most cereal grains, are long-day plants and should be grown during spring or summer for best results.

Short-Day Vegetables

Finally some short-day plants among the vegetables should be mentioned. Soybeans and some corn varieties, for example, grow vegetatively during early summer, and start to flower some time later. It does no good to sow soybeans much earlier in the spring; later-planted ones will flower and fruit at the same time.

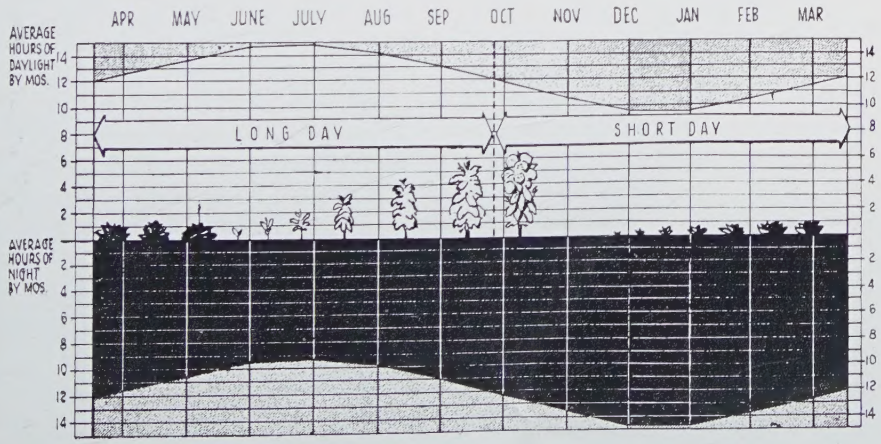
This all sounds very simple. But whereas the principles along which nature works are simple, nature often employs so many principles at the same time, that the results seem hopelessly complicated. In the previous

disussion, only those cases have been mentioned where photoperiodicity was so predominant in causing flowering that the complexity did not appear. But many plants can tell the time of year only by a combination of night temperature and length of day. Take the case of Poinsettia. When the temperature is too high (70°) it does not flower at all, neither in long nor in short days. Therefore, Poinsettias cannot be grown in the lowlands of the tropics. At medium temperatures (60–65°) it is a short-day plant, which corresponds to what we observe; it flowers around Christmas. But if the temperature is still lower (55°), poinsettia flowers even in long days.

Night Is The Regulator

Ever since Garner and Allard did their first experiments 25 years ago, we have been talking about long- and short-day plants, without knowing whether the day length or the length of night was the important factor. Since we knew that light was essential for growth, we just assumed that it was the day which regulated the flowering. But experiments carried out to test this gave most unexpected results. By growing plants in artificial light, it was possible to give a long-day (light) treatment in combination with a long night. Under these conditions only short-day plants flowered, that is to say, short-day plants should rightly be called long-night plants. The companion experiment showed that long-day plants actually responded only to the short nights, for they flowered in the combination of short day and short night. Under those conditions, the short-day plants did not flower. A still clearer proof was provided by giving short-day plants five minutes of light during the middle of the night. Then they had a short day in addition to two short nights, separated by a light period of five minutes. Thus they

Many plants are set like alarm clocks. Spinach continues leaf growth until day reaches length of 12 hours or more and signals that it is time to produce seed. The Chrysanthemum will not bloom until days shorter than 12 hours give the signal.



did not flower. Therefore the work on photoperiodicity points to the importance of the night period for plant growth. This same conclusion was reached in the experiments on growing plants in different temperatures: growth and fruiting were profoundly affected by the temperature during the night. To summarize: many plants can tell the time of year by the length of night. Their flowering and growth are dated by the nights being shorter or longer than a critical number of hours.

Practical Use

Growers are now developing varieties to meet photoperiodicity. Planting dates are based on the night-day length. In northern countries the winter days are so short that strawberries seldom flower and set fruit before March. Eight hours of additional neon light, given after midnight when electric current rates are lowest, give a good strawberry crop. During winter, prices for fresh strawberries are so high that a good profit can be made even after deducting the costs of installation of the lights and of electric current. In the same way Cinerarias, Gloxinias, and other plants, ordinarily not flowering in the middle of winter, can be grown commercially and offered for sale blooming at any time.

TRUE CEDARS

JAMES A. DUKE

There is little greenery left in the Ozarks. The drab of winter is firmly entrenched; brown is the dominant color of the trees, naked save for a few straggling withered leaves, which refused to fall with the autumn. In contrast with the western and eastern states, Missouri, with its hot dry summers, possesses few native evergreens. There are only two evergreen conifers to enhance the landscape. Almost everyone knows them by their colloquial names, the pine and cedar. The word *cedar,* in the Old Testament particularly, is often encountered. Surely this use of the word antedates any use of the word in America. Is the cedar from which the temple of Solomon was wrought the same cedar that dots the Missouri landscape?

In the United States, cedar has long been the name applied to two native genera, *Chamaecyparis,* the white and yellow cedars, with species to our east and west, and *Juniperus,* with several diverse species to our west and east, and with one species, *Juniperus virginiana,* the red or pencil cedar, common and well known throughout Missouri. Neither of these coniferous genera is to be confused with the subtropical spanish cedar *Cedrela,* a broad-leaved member of the Mahogany family. The spanish cedar, and to some extent, the red cedar, is the "cedar" of carpentry. The true cedar, so often encountered in the Bible, is none of these. It is in fact much closer related to the pine than to any of our American "cedars." The true cedar was even first classified as a pine by Linnaeus, the founder of modern systematic nomenclature, who called it *Pinus cedrus.* More recently the genus *Cedrus* has been erected for

the true cedars, which are not even native to the New World.

The true cedar shares two features with the pines; the leaves on mature branches are borne in fascicles, and the cones are large and dry, like those of the pine, as contrasted to the pea-sized cones or "berries" of the white and red cedars respectively. True cedars are different from pines in that the fascicles contain ten to forty needles and do not have a sheath; in the pine there are usually only one to eight needles, and these are bound together at the bottom by a girdling sheath. The leaf arrangement is somewhat reminiscent of the larch *(Larix)*, but the leaves of the larch are deciduous, and the scales of the cone are persistent. In the true cedar, the scales of the cone fall shortly after a heavy rain leaving a denuded spool-like central axis. Another characteristic feature of the true cedar, which becomes evident only in the older trees, is the flattened top. This is illustrated nicely in the photograph of the Mt. Atlas Cedar in cultivation at the Kew Gardens.

Among the true cedars, three species are generally recognized, although the differences between them are often very obscure. These are the Mt. Atlas or Atlantic Cedar *(Cedrus altantica)*, from northern Africa; the Himalayan or Deodar Cedar *(Cedrus deodara)* and the Cedar of Lebanon *(Cedrus libani)*, both from the mountains of Asia Minor. Today after more than six thousand years of lumbering without foresight, the cedars are very localized in their natural distribution. Evidence from fossils suggests that they were once much more widespread, occurring in Europe, even in Great Britain.

The Mount Atlas Cedar *(Cedrus atlantica)* has needles which are mostly

Cedrus atlantica, Kew Garden

Cedrus deodara, Linnean House

less than an inch long; its branchlets are minutely hairy, and its cones are two to three inches long, with flattened or concave tip. In other respects it resembles the Cedar of Lebanon, and both possess rather stiff branches in contrast to the "weeping" Deodar Cedar. The Mt. Atlas Cedar, a native of northern Algeria and Morocco, where snow often lies for several months, should prove fairly successful in the St. Louis area. It does not seem to be widely planted here. Among several varieties, the variety *glauca* is especially attractive because of waxy blue foliage.

The Deodar Cedar *(Cedrus deodara)* has needles one to two inches long. Its branchlets are also minutely hairy, and its cones, rounded at their tips, are the largest among the cedars, attaining a length of three to five inches or more. At a distance, the Deodar Cedar can be differentiated from other cedars by its gracefully pendent leaders and branchlets. Its cones are a bit more colorful than those of the other cedars, because of a rusty cast added to the rather prosaic brown of most cones. The Deodar occurs naturally in the western Himalayas, from Afghanistan to Sarhwal, where it may attain a height of two hundred feet or more and a girth of fifteen to twenty feet. Unfortunately the Missouri climate is rather detrimental to this, the most attractive of the cedars, and it is rarely successful in this area. It is presented nicely in the Camelia House at the Garden, where the humidity is more favorable. As all species of cedar, this is, or has been, an important timber tree, and at one time or another it has been used as a pharmaceutical. Pliny mentions the distillation of "Cedria," an archaic remedy for toothache, closely akin to creosote, a more recent, but nevertheless archaic, dental panacea.

Cedrus libani, Gray Summit

A perusal of the books of Kings I and II and Chronicles will yield an abundance of references to the Cedar of Lebanon *(Cedrus libani)*, for millenia a conifer of both economic and aesthetic importance. This stout tree has leaves which are usually a little more than an inch long. The branchlets are nearly or completely devoid of hair, and the cones, which are apically flattened or concave, range from three to four inches long. At home in the mountains of Asia Minor, but widespread through cultivation, this is the most common of the true cedars cultivated in the St. Louis area. At the Garden, there is a small specimen

thriving in front of the experimental greenhouse. At Gray Summit is a specimen about thirty feet high, which is yet too young to show the characteristic flat-topped appearance of the older cedars. You will note that the tree is twinned, which seems to be the rule rather than the exception in the cedars in their natural habitats.

In contrast to most of our native North American conifers, the cedars typically shed their pollen in the fall. Like the pine at time of pollination, the cedars release torrents of golden pollen when disturbed by the wind or the botanist or whatever. The tree at Gray Summit was so heavily laden with pollen last October that it appeared to be diseased. As in many conifers, the male and female cones are borne on different branches or even on different plants. No female flowers were found on the tree at the arboretum so until such are found, we may assume that our tree is a male. Conifers present many sexual anomalies however; some are strictly males and females; others may produce male and female cones on the same tree in varying proportions in different years; in still others aberrations are not at all uncommon in which a single cone may be partly female and partly male.

Cedrus deodara, female

Cedrus atlantica, male and female

Cedrus libani, male

As told in the second book of Chronicles, the story of the construction of Solomon's temple, seven years in the making, gave to the Cedar of Lebanon a dominant role. Even Solomon's sedan was cedar. Thousands of conscriptees and slaves were sent into the mountains to strip them of their cedars, destined to be used in one or another of Solomon's projects. Since the cedar was the preferred lumber of the Israelites and their neighbors, the cedar population has long since been decimated. This doubtless contributed, in a limited extent, to the aridity problem which challenges the Israelis today.

Then as now the cedar is a symbol of strength to many people. Strength is not the only attribute of the wood. As in many conifers, resinous by-products of the plant's metabolism are concentrated in the wood. These resins impart a lasting quality to the wood so that it is particularly desirable for structures which must endure prolonged contact with the soil. Egyptian mummies were often encased in caskets of cedar, probably the Mt. Atlas Cedar, and many ancient artifacts, carved of cedar, have survived ages of weathering. Probably most important to us is the beauty of the legend tree, the Cedar of Lebanon, but there is little need for me to extol it more. Terse but adequate praise can be found in Psalm 92: verse 12: "The righteous shall flourish like the palm tree; he shall grow like a cedar in Lebanon."

THE ANACARDS

C. H. DODSON

The Cashew Family, Anacardiaceae, is a family which carries a vary bad reputation here in the temperate climes. We are most familiar with its representatives here as "Poison Oak and Ivy" and "Poison Sumac." Most of us tend to carefully avoid them when we recognize them by their glossy, greasy looking foliage and gray-white, sticky berries—the red berried sorts being considered harmless. It is wise to be careful, for the results of contact with the resins produced by the plants can be most uncomfortable and can even cause severe dermatitis in susceptible persons. Poison Oak and Poison Ivy are normally considered as being botanically the same species, *Rhus toxicodendron,* common throughout the United States either as an erect, numerously branched shrub or as a scandent, or climbing vine which covers up the trunks of trees and rock faces. Both of these forms cause an annoying rash on the average person's skin, usually in the area of contact. Some persons are not affected by the plant while some few people become seriously ill as a result of their encounter. Poison Sumac, *Rhus vernix,* is a native of eastern United States and is considered as more serious than poison oak. It is one of the earliest plants to change the color of its leaves to bright red in the early fall, and unwary persons occasionally collect it for indoor decoration—with unhappy results. Several harmless spe-

cies appear nearly identical with it in habit of growth, leaves, and flowers, but the only easy way to separate the vicious species from the harmless is by the berries. The harmless ones have bright red berries and the toxic ones have dirty-white berries.

Several of the tropical members of the family are also surprisingly venomous to the unwary. *Metopium* and *Comocladia,* from the Carribean region and Central America, are intensely poisonous. *Rhus striata,* closely related to our Poison Sumac, is quite dangerous. The natives refuse to cut it when clearing the forest for agricultural purposes, saying that the tree "burns."

To illustrate what can happen to a fledgling tropical botanist when he is not careful, I would like to relate a short but sad episode. A few years back I was making population studies of some of the variable orchids in Ecuador. One of the projects was to study and collect a particularly beautiful and seldom seen species of *Schomburgkia* in the Province of Esmeraldas. We were in one of the dry desert-like valleys on the western slopes of the Andes which seem so strange, for only a few miles away can be seen the soggy tropical rain forests which receive heavy precipitation throughout most of the year. These dry valleys result from the moisture-laden clouds being strained of their moisture by the sheltering mountains and little rain is left when the clouds reach the valleys.

It was an extremely hot day. As we wandered along we noted that the natives had all but cleared the region of trees and shrubs which were large enough to provide fire wood. Rather than attempt to climb the few remaining large trees to collect the flowering orchids we looked about in search of a tree or bush from which we might cut a pole to use in dislodging the plants. One can remove them with a good pole with ease and we were not in a mood to exert ourselves any more than absolutely necessary. Around a bend in the trail we came upon a small tree of just the characteristics necessary and after a few machete whacks we had a remarkably long and light pole suited to our needs. It was so excellent in fact that I personally carried it for the rest of the day, using it regularly. I noticed that it seemed to be exuding a black greasy substance but I dismissed that fact in the excitement of the collecting.

Late in the afternoon a young man came sauntering down the trail, smiling and saluting us. He was curious as to what we were doing with the orchid plants and stopped to chat. His eyes came to rest on the pole in my hands and suddenly his facial expression changed to one of horror and he immediately turned and bid us good day. "Strange people, these Ecuadorian counterparts of our hill billies," I thought as I wiped the sweat from my brow with my hand.

There was no hotel in this region and no water for bathing and since we had worked late we bedded down on the floor of a friendly soul's front porch and spent the night. The following morning I felt strange. A combination of symptoms of extreme sunburn, horrible itching and general swelling throughout my body made

me feel that this little expedition should come to an end. The following two weeks in the hospital—swollen out of all proportion to a human being and thoroughly miserable—gave an opportunity to reflect on the reasons for the strange behavior of the young man on the trail. It also dawned on me that any small tree left in an area where all others had been cut for fire-wood should be suspect.

After recovery I went back to make a careful but more critical examination of my orchid pole tree and it turned out to be *Rhus striata.* Discussion with the local inhabitants of the region revealed several interesting things, mostly based on folk lore but with an obvious basis in reality. I was informed that sleeping under the tree was certain death. That just walking past the tree could lead to dire results if one were not careful to tip his hat and give a pleasant greeting.

Not all of the members of this family are poisonous; in fact it is only a small minority that are so endowed. For instance, in the genus *Rhus* approximately 150 species are known, of which only 5 or 6 are poisonous. *Rhus glabra,* the "Smooth Sumac," was used during the pioneer days to make a kind of lemonade by dipping the fresh fruit panicles into warm water and then cooling.

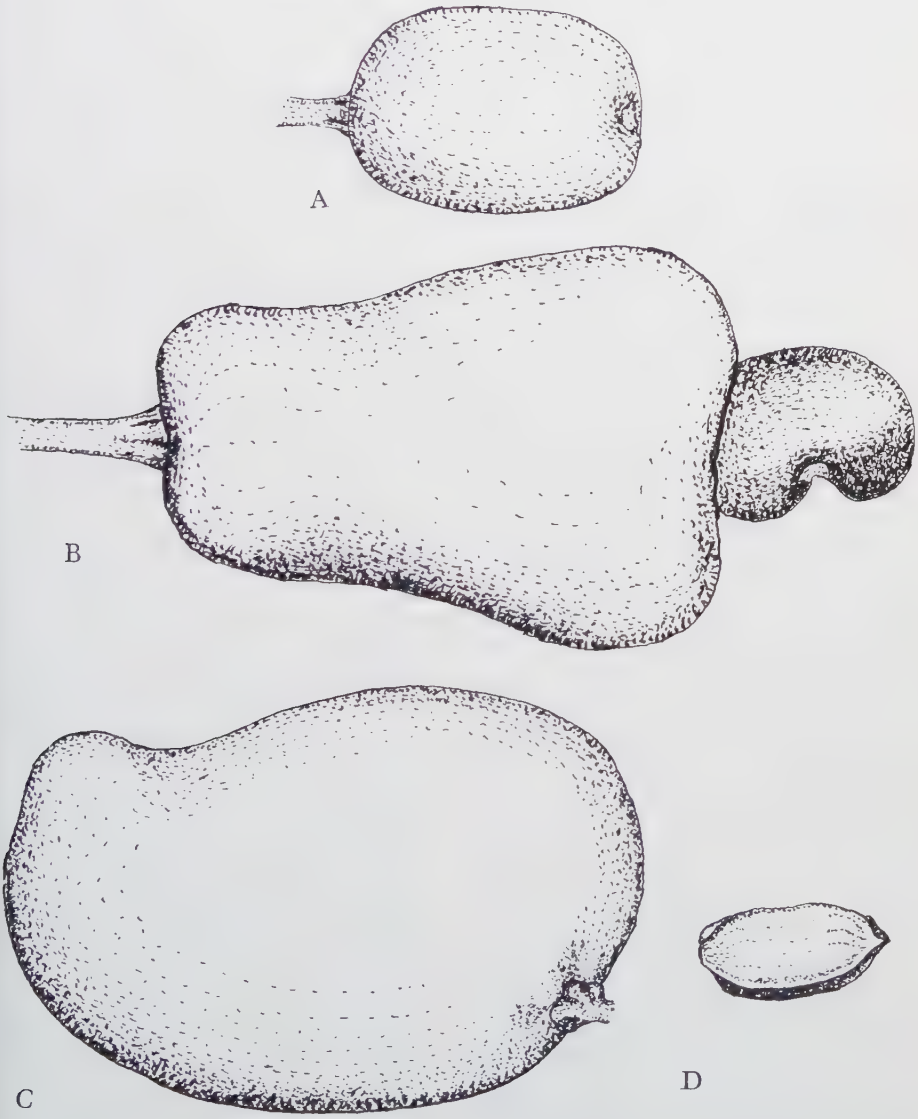
Few of us realize that several of the most appetizing fruits and nuts of tropical regions belong in this family. Scarcely a more delicious fruit is to be found than a really good variety of Mango, such as Hayden, with which perhaps only a fine peach can compare. It is a sad fact, however, that few of the really good new varieties of Mango developed in Hawaii and the Philippines, are common in cultivation in tropical American countries. This does not bother the children, however, for during Mango season the streets are littered with the large fibrous seeds. This very situation of numerous seeds being scattered, germinating and growing quickly into producing trees, has contributed to the lack of good varieties. Also, the unselected seedlings pollinate and thereby soon degenerate the better varieties. Most persons in Latin America simply harvest what is available and are not too concerned because the fruit is small, fibrous and has a flavor of turpentine.

In places like Hawaii and the Philippines, Mangos are carefully selected to improve the strains and most of the fibers and unpleasant flavor of the rinds have been removed. A visit to the Agricultural Research Station of the University of Hawaii in September can be a pleasant sojourn with seemingly countless varieties to taste and compare. Also one can occasionally leave with a distressing rash when he discovers that he is allergic to Mangos.

Few people here know that the Cashew Nut, *Anacardium occidentale,* is distantly related to Poison Oak and that in Tropical America most people eat the stem and throw the fruit away. Actually, the fruit in this plant is the nut as we know it, including an outer shell which is stripped off when the nut is roasted. The part that the Latin Americans eat is technically the swollen receptacle, or stem, of the fruit. It is about the size of a large plum and is soft and juicy. The nut

it attached to the apex of this swollen receptacle and the name of the family —Anacardiaceae—is taken from the heart shaped outer cover of this nut.

The "Maranons," as this fruit is called there, is very popular. The fruit-like receptacles are delicious fresh and are made into sherbets, soft drinks and



Fruits of the Anacards: A, Spondias; B, Cashew; C, Mango; D, Pistachio. Approx. size.

even fermented to produce a kind of tropical "white lightning." Unfortunately, the fruit is so delicate that it cannot be shipped and therefore we never see it here on the market. As if to show its relationship to the Poison Oak and Sumac, this beautiful small tree also produces a strong poison but in this case the poison is in the shell which covers the nut. If this shell is carefully removed from the fruit, no danger is involved in eating it. After the nut has been roasted it, too, is not only harmless, but as we well know, delicious.

One other species of *Anacardium* is common in southern Central America and northern South America. This is *Anacardium excelsum,* a giant forest tree from which the natives make their dugout canoes. It also produces an edible fruit but is inferior to *Anacardium occidentale.*

The well known, but expensive nut, the Pistachio, *Pistacia vera,* belongs here. This tree is a native of Asia but we have a species of the genus indigenous to southern Texas. Nearly everyone enjoys popping open the husks of Pistachios and picking out the richly flavored meats once they have been roasted and salted. Unfortunately, the demand outstrips the supply and thus they have remained a luxury item.

Another popular fruit from this family in tropical America is the "Mombin" or "Ciruela," *Spondias mombin,* often called the "Spanish Plum." The thick-branched, low trees are common throughout tropical regions, particularly in dry areas, and are both semi-cultivated and wild. The fruits are about the same size, shape and color as our red plums and have a remarkably similar flavor, being slightly acid. During certain periods of the year they are very common in the market places and are quite inexpensive. An estimate of the enormous number of these trees can be based on the fact that children eat the nuts with salt, voraciously, while they are still completely green. Considering the quantities which reach the market after that onslaught, one comes to realize that it is a common tree. Unfortunately, some persons, the author for instance, are allergic to these Anacards as well as to Poison Oak.

A number of plants from the family make excellent horticultural subjects grown for their foliage, particularly in tropical and semi-tropical regions. Several varieties of Rhus, as the Staghorn Sumac, *Rhus typhina,* are grown in our gardens. Few trees are more beautiful than the large Mangos grown in tropical areas. *Campnosperma* and *Semicarpus* are also well know in tropical and semi-tropical regions for their beauty. *Schinus terebinthifolius* and *Schinus molle* are common in southern California and Florida. The "Smoke Tree," *Cotinus coggygria,* is an extremely colorful small tree or shrub in our gardens because of its densely plumose, purplish panicles of flowers, followed by plumose sterile pedicels accompanying the filiform ones. The "pink smoke tree" is a handsome new form with bronze colored leaves.

EXTRAORDINARY USES OF LEGUME SEEDS

Ever since the Cro-Magnon man rolled a pea seed in his hand and fingered a hollow stem, only to realize its potential as a pea-shooter, the legumes have had a variety of uses apart from culinary or medicinal applications. Such variety represents a fascinating gamut. Witness, for example, the mundane use of beans in the game of bean-bag. Recently in examining a stuffed alligator-skin about 2 feet long, I noted that the scarlet "eyes" with a black "pupil" were the brilliant red seeds of *Erythrina*; this close relative of the familiar coral bush has a plack spot near the seed scar *(hilum)*. The large plump and rotund seeds of a tropical vine *Mucuna* are called *donkey's eyes,* bearing a striking resemblance to the eye of this animal.

Equally interesting is the use of the ordinary dry bean seeds (these being large, cheap, and easily procurable) in the process of disarticulating cleaned-out skulls. After pouring the seeds through the large cavity *(foramen magnum)* at the base of the skull until the inside becomes filled, and subsequently immersing the skull, the bones separate cleanly along their natural sutures. Substances in the seed coat, called *hydrophylic* colloids, attract water like a magnet attracts metal; as a result the seed coat swells appreciably. The total force exerted by the over-all expansion of the seeds is tremendous and the bones readily separate. From skulls to rosaries may seem a big step, but we note that the seeds of the *rosary pea (Abrus precatorius)*, as is suggested by the Latin specific name, are widely used in the manufacture of chaplets or beads in tropical countries. In times past the dried seeds of the same rosary pea were frequently employed in the weighing of diamonds; they were erroneously thought to be constant in weight, i.e. the equivalent of a grain or 1/1000 part of a pound avoirdupois. One interpretation of the word *avoirdupois* of the Old French means "to have some peas." It would seem to suggest that peas were used in weighings; apparently the word suffered a slight change in orthography and acquired a facetious meaning, being linked with the notion of corpulence. The word *carat* (a weight for gems, about 3.2 grains) is thought to be derived from the Hindu Indian word *retti* meaning seed.

The combustible properties of the fruit of the tropical American arboreal genus, *Dipteryx,* are noteworthy. B. C. White, the author of "The White Indians of Darien" observed (pp. 96–97) that the Indians near the Colombian border of Panama use the fruits of Dipteryx to make torches: "they consist of about 20 nuts of the *almendra* tree, rather like nutmegs in shape and size. They are strung tight against each other on a long black sliver of black palm and when lighted give a light about as bright as a common kerosene lantern. As one nut is consumed, it lights up the next one." In tropical countries the seeds of the leguminous vine, *Entada gigas,* are used as trinkets. One botanist (I. Johnston) described them as about the size and shape of a pocket-watch and

having glossy mahogany-colored coats. Not infrequently they are heart-shaped instead of round and are highly prized as pendants. The fruits which bear them are often longer than a yard-stick.

Peas are used in a routine laboratory experiment to demonstrate that plants like animals "breathe," i.e. carry on respiration. In this process oxygen, passing through the seed-coat, burns as it were, complex foods like sugars; as a result, water and a gas, carbon dioxide are formed, with heat being given off in the process. The peas are divided into two groups, one soaked in water, the other soaked in formaldehyde, and subsequently segregated in 2 vacuum tubes similar to a thermos bottle; these are sealed with corks through which a thermometer has been inserted. Inasmuch as formaldehyde is toxic to living tissue, the dead peas will release no heat of respiration and consequently no change will be noted in the mercury column of one thermometer; the other tube with the water-soaked seeds, will show in a short time an obvious rise in the mercury column, reflecting the loss of heat through the oxidation of the substances in the respiring seeds.

It is a apropos to point out that the so-called *Mexican jumping beans* (really fruits of *Sebastiana palmeri*) are not beans in the sense of belonging to a species of leguminous plant; they are derived from a species of the spurge family (Euphorbiaceae). The jumping effect of the bean is due to the writhings of a lepidopterous larva living inside the fruit.

Despite the importance of any kind of seed, whether from legume, mint or rose, in terms of food, medicine, industrial use, decoration or experiment, its prime significance is its possession of a living embryo. As the hope and perpetuation of the human race can be interpreted in a sense in terms of the maternity wards of our hospitals, so the hopes for a perpetual Spring lie in the womb of the earth with its variety of seeds, each one sustaining a miniature plant eager for its hour of emergence.

J.D.D.

THE PELLITORY PROBLEM II

In the Bulletin for October we presented the strange case of our native pellitory, *Parietaria pensylvanica*. It has become a common weed in St. Louis, though neither in the literature nor in the herbarium can we find any record of its having been weedy, here or elsewhere. Since the article appeared, Dr. V. Muhlenbachs, an honorary member of our staff, has come forward with even more precise evidence as to its status in St. Louis.

Since 1954 Dr. Muhlenbachs has been engaged, in his spare time, in producing a flora of the railroad tracks and freight yards in the City of St. Louis, a precise record of the weeds and waifs, (and occasional survivor of the original flora) which are to be found growing under these unusual conditions. Dr. Muhlenbachs has collected the pellitory five times and has seen it on other occasions, sometimes growing in great abundance. It has

been collected on both the Wabash and Missouri Pacific rights of way; not only along the tracks but also in the large freight yards. There is even a suggestion, as at the Garden, of the kind of way in which it might have spread from its original site to the railroad properties. Dr. Muhlenbach's first collection on June 13, 1954, was along the M. P. right of way near Dover Street where, as he says, "the tracks enter the narrow space between the levee of the Mississippi and the steep and very high bluff." At such a site the pellitory might have made its transition from its original status as a rock plant to an ubiquitous weed. Elsewhere along the tracks and in the freight yards Dr. Muhlenbach's impression of it is of "a typical weedy species, growing copiously in more or less dense colonies."

A former member of the Horticultural Council, Mr. Robert Waln, of Drexel Hill, Pennsylvania, has written about his experiences with the weediness of *Parietaria pensylvanica*—"When a boy, my father charged me with the task of eradicating *Parietaria pensylvanica* from our Bonny Brook Farm, near Clearfield, Pennsylvania, after learning I had transplanted some from a restricteed area of our Sunny Steppe Farm in the Grampian Hills twenty miles distant."

This additional evidence merely points up the problem posed in the original notice. Has this native rock-plant just recently made the transition to weed-dom in the St. Louis area or has this been going on generally for a long time but outside the notice of scientists?

E.A.

MAUSOLEUM RESTORATION

THE mausoleum of Mr. Henry Shaw, started before his death in 1889 and finished shortly thereafter, has been completely renovated and made secure for at least an equal time to come.

The work was planned and ordered by the Historical Committee of the Women's Association of the Garden in the Fall of 1960. The renovation was under the direction of Mrs. Fothergill Graves, Special Consultant, with the metal work and most of the detail being handled by Mr. Robert T. Theiss of the Theiss Plating Corporation. The leaded glass windows were repaired and reset by Emil Frei, Incorporated. The stone work was cleaned by the

Vittert Building Cleaning Company. The painting was done by the J. R. Meade Company. The roof repairs were made by the Mound City Roofing Company.

The structure as it was originally built was solid and amazingly true. Little or no settling has taken place over the years. The recent cleaning and renovation reveals the beautiful pink Missouri granite, the brightly colored leaded windows and restores the quiet dignity which was Mr. Shaw's wish for this tomb, his final resting place.

E.L.E.

MISSOURI BOTANICAL GARDEN EDUCATIONAL PROGRAMS

SPECIAL SHOWS AND DISPLAYS

Orchid Show, January 22 to February 26th.

FREE NATURE PROGRAMS for children, aged seven and over, are held every Saturday morning from 10:00 to 11:30 A. M.

The Mystery of the Orchid, February 4th

The Green Thumb at Work, February 11th.

Color Sound Movies, February 18th.

Plants in a Capsule, February 25th.

COURSES FOR ADULTS. Beginnning in February:

Area Management, 4 sessions; fee $8.00. Wednesdays, February 1st to 22nd, 8:00 to 9:30 P. M.

Practical instruction on erosion control, weed and brush control and basic management of ponds. Specialized instruction in management of meadows, marshes and forests will be explained, emphasizing recreation and wildlife.

SPECIAL LECTURE ANNOUNCEMENT

FOR

MONDAY, FEBRUARY 6, 1961, AT 8:00 P. M., MUSEUM BUILDING

Dr. Arthur Ringoet, recently from the Congo, will introduce and show a color film to illustrate the work of the Belgian Agricultural Research Institute in the Congo. Dr. Ringoet is now engaged in research at the Garden on the translocation of sugar in rice. This work is supported by a grant from the Rockefeller Foundation.

BOARD OF TRUSTEES

ROBERT BROOKINGS SMITH, President
LEICESTER B. FAUST, Vice-President
HENRY B. PFLAGER, Second Vice-President

HOWARD F. BAER
DANIEL K. CATLIN
SAM'L. C. DAVIS
HENRY HITCHCOCK
JOHN S. LEHMANN
ROBERT W. OTTO
WARREN MCKINNEY SHAPLEIGH

EX-OFFICIO MEMBERS

EDWARD C. DONNELLY President
Board of Education of St. Louis
GEORGE L. CADIGAN, Bishop
Diocese of Missouri
STRATFORD LEE MORTON, President
Academy of Science of St. Louis
ETHAN A. H. SHEPLEY, Chancellor
Washington University
RAYMOND R. TUCKER, Mayor
City of St. Louis

HONORARY TRUSTEE

DUDLEY FRENCH

OSCAR E. GLAESSNER, Secretary and Controller
WALDO G. FECHNER, Assistant Controller

HORTICULTURAL COUNCIL

Clifford W. Benson, Paul Bernard, Mrs. Paul H. Britt, E. G. Cherbonnier, Philip A. Conrath, Carl Giebel, Robert E. Goetz, Paul Hale, Earl Hath, Mrs. Hazel L. Knapp, Dan O'Gorman, Gilbert Pennewill, Ralph Rabenau, F. R. McMath, Chairman.

STAFF

Frits W. Went.....Director
Hugh C. Cutler.....Executive Director
Edgar Anderson.....Curator of Useful Plants
Henry N. Andrews.....Paleobotanist
Clarence Barbre.....Instructor
Louis G. Brenner.....Arborist and Grounds Superintendent
George S. Bunting.....Taxonomist
Ladislaus Cutak.....Horticulturist and Greenhouse Superintendent
Carroll W. Dodge.....Mycologist
Robert L. Dressler.....Taxonomist and Editor of ANNALS
James A. Duke.....Assistant Curator of the Herbarium
John D. Dwyer.....Research Associate
E. L. Evinger.....Horticulturist and Editor of BULLETIN
Robert J. Gillespie.....In charge of Orchids
Paul A. Kohl.....Floriculturist
C. Ranlet Lincoln.....Assistant to the Director
Viktor Muehlenbachs.....Research Associate
Norton H. Nickerson.....Morphologist
Lillian Overland.....Research Assistant
Dorothy Panos.....Friends of the Garden Secretary
Kenneth O. Peck.....In charge of Visitors' Activities
George H. Pring.....Superintendent
Owen J. Sexton.....Research Ecologist
Kenneth A. Smith.....Engineer
Frank Steinberg.....Superintendent of the Arboretum, Gray Summit
George B. Van Schaack.....Librarian and Curator of Grasses
Trifon von Schrenk.....Associate Curator of the Museum
Robert E. Woodson, Jr.....Curator of Herbarium

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical (Shaw's) Garden was established in 1859 by Henry Shaw, a St. Louis businessman, to be controlled by a Board of Trustees for the public benefit. The Garden is a non-profit institution which receives no support from the city or state, depending on the income from the Shaw estate supplemented by contributions from the public.

The old stone walls and cast-iron fences, the Linnean House, the Museum Building, the part of the Administration Building which was Shaw's Town House, relocated in the Garden in 1890, and the Tower Grove House, his country home, all date from Mr. Shaw's time. The Main Gate, display and growing greenhouses and most other facilities date from the period immediately following the turn of the century. The Climatron, opened in 1960, is the first of several new buildings planned for the Garden's redevelopment. It is the world's first geodesic dome, fully climate-controlled greenhouse and contains the Garden's tropical collections.

The Garden — 70 acres — is open every day of the year (except Christmas and New Year) from 9 A.M. until sundown, and the greenhouses close at 5 P.M. Tower Grove House is open daily from 1 P. M. to 4 P. M. (December to March on weekends only). The Display House presents four seasonal displays:— November, Chrysanthemums; December, Poinsettias; February, Orchids; Spring, Lilies and other flowers. During the year are other shows, competitions and festivals sponsored by various Garden Clubs and Flower Societies.

Courses in Botany and Horticulture for adults are conducted by the Garden staff. Children's nature studies are provided each Saturday of the year and a special nature program is held during the summer. Information on these activities is published in the BULLETIN or may be had by mail or phone. The Garden maintains a research program through the Henry Shaw School of Botany, Washington University.

In 1926 an Arboretum — 1600 acres — was established at Gray Summit, Missouri. Foot trails and roads pass through the Arboretum and are open to visitors in April and May.

The Garden Administration Building is located at 2315 Tower Grove Ave., and the Garden main entrance is at Tower Grove and Flora Place. The entrance at Tower Grove and Cleveland Avenue is also open to the public. The Garden is served by both the Sarah (No. 42) and the Park-Southampton (No. 80) city bus lines.

Persons interested in helping to support the Garden and taking part in Garden activities are urged to do so through the "Friends of the Garden". Information may be obtained from the Main Gate or by mail or phone.